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MODEL 3555

ROTL ACCESS UNIT

Northeast Electronics Instruction Manual
A3555-00-600 Issue 3 February 1984

northeast electronics
DIVISION OF tau-tron inc.
A UNIT OF GENERAL SIGNAL

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MODEL 3555
ROTL ACCESS UNIT
INSTALLATION AND OPERATION

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1. GENERAL

A. Scope of Manual

1.01 This manual describes the features of the Model 3555 ROTL Access Unit and its use in the automatic transmission measuring system environment. Table A is a list of abbreviations and acronyms used in this manual.

1.02 Whenever this publication is reissued, the reason(s) for reissue will be listed in this paragraph.

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TABLE A

ABBREVIATIONS AND ACRONYMS

ABS	Acrylonitrile Butayadine Styrene (Plastic)
ALL	Step through codes X1 to X7
ATMS	Automatic transmission measuring system
BALT	Balance and longitudinal termination
CAROT	Centralized automatic reporting on trunks
DAT	Drop access trunk
DDD	Direct distance dialing
DP	Dial pulse
EM SCC	Electromechanical switching control center
EPROM	Eraseable programmable read only memory
ERL	Echo return loss
ERLSC	Echo return loss self-check
ESS	Electronic switching system
HOTL	Home office test line
KP	Preparation for digits MF code
LED	Light emitting diode
LOSS	Loss 1004 at 0 dBm0
LSC	Loss self-check
LSC4	Loss self-check at 400 Hz
LSC10	Loss self-check at 1 kHz
LSC28	Loss self-check at 2.8 kHz
MANL	Manual loss
MBO	Maintenance busy override
MF	Multifrequency signaling
MTBF	Mean time between failure
NFN	Noise far → near
NNF	Noise near → far
NSC	Noise self-check
N/T	Noise with tone
NTSC	Noise with tone self-check
OTTS	Outgoing trunk testing system
P/AR	Peak/average ratio
RAM	Random access memory
RAU	ROTL access unit
RCYL	Recycle
REL²	Release/release
RFWD	Ring forward
ROGT	Remote outgoing trunk
ROTL	Remote office test line
ROM	Read only memory
SC	Self-check
SCC	Switching control center
SCK	Self-check
SPH	Singing point high
SHISC	Singing high end self-check
SPL	Singing point low
ST	End of pulsing sequence MF code
TLP	Transmission level point
TPT	Test progress tone
TST	Test
TT	Touch-tone®
TUT	Trunk under test
μP	Microprocessor
404	Gain slope at 404 Hz and – 16 dBm0
1004	Gain slope at 1004 Hz and – 16 dBm0
2804	Gain slope at 2804 Hz and – 16 dBm0

B. Applications

1.03 The Model 3555 RAU provides a portable means of direct manual control and interrogation of CAROT remote office test lines and automatic transmission measuring systems equipment. The unit produces command signaling to set up the required testing routines. A data receiver decodes test results which are exhibited on an LED display.

1.04 The Model 3555 RAU is capable of performing cooperative two-way testing with the following equipment:

NED TTS 1050 Series
WECO Model 51B Responder
WECO Model 52A Responder
WECO Model 56A Mini-Responder
APC 1051 Test Line Responder
AECO 105 Responder

2. DESCRIPTION

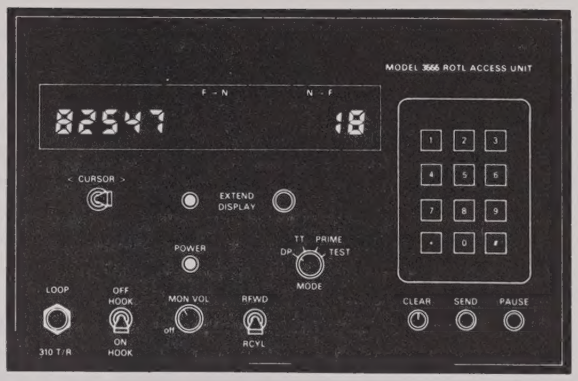
A. Physical Description

2.01 The Model 3555 RAU is contained in a portable enclosure which measures 5½ inches high, 8½ inches wide, and 9¾ inches deep. The housing for the unit is molded of ⅛-inch high-impact ABS material. The unit is provided with a locking multipurpose handle and is easily carried with the handle fully extended forward; or the handle can be used as a tilt stand. Handle position is maintained with a series of detents which are molded into the case. The handle is unlocked by simultaneously pulling both handle pivot points away from the case and positioning as desired.

2.02 The basic Model 3555 RAU weighs approximately 5½ pounds. An accessory carrying case with a fitted interior (option) has exterior dimensions of 17¼″ × 11¾″ × 7¼″ with an additional weight of approximately 2 pounds.

B. Controls and Indicators

2.03 Model 3555 RAU controls and indicators are shown in Fig. 1.



A02633-00

Fig. 1—Controls and Indicators

2.04 Display

2.05 The display is a 15-digit, 7-segment LED display with a ⅜-inch character height. The display is used in five modes which are described in Table B.

TABLE B

DISPLAY MODES

MODE	EXPLANATION
SELFTEST	When the instrument is initially powered up, a routine check of the microprocessor circuitry within the instrument is performed. Satisfactory completion of this step results in a "PASS" indication on the first four digit locations of the display field. "PASS" displays for five seconds and is then automatically extinguished. At this point the instrument is ready to use.
DDD ACCESS	The access number entered into the memory of the Model 3555 is displayed for verification and editing. Pauses in the outpulsing sequence are indicated by a dash (—) on the display.
PRIMING	The priming field (up to 30 digits) is displayed for verification and editing. The KP and ST codes required to bracket the priming field are not displayed, but are automatically sent during outpulsing.
TEST	The two-digit test preparation code appears in display locations 1 and 2. A separating dash (—) appears at location 3 followed by the two-digit instruction code in locations 4 and 5.

TABLE B (Cont)

DISPLAY MODES

MODE	EXPLANATION
TEST (Cont)	The near-end received data is displayed in digit locations 8, 9, and 10, centered under the F → N label on the display filter. Negative values of received data are preceded by a minus sign. Positive measurement readings are unsigned. The far-end data is displayed in digit locations 13, 14, and 15, centered under the N → F label on the display filter. Negative values are preceded by a minus sign.
CHECK SUM	The last two digits of the DISPLAY EXTEND field indicate the total number of priming digits which have been entered.

2.06 Controls

2.07 Model 3555 RAU control functions are described in Table C.

C. Equipment Options

2.08 Carrying Case

2.09 This option is an accessory carrying case with a fitted interior.

D. Power

2.10 The Model 3555 RAU is powered from a 120 V ac source. The power switch is incorporated in the MON VOL located on the front panel. The green POWER lamp illuminates when the unit is on. A protective ¼-amp, 3 AG slo-blo fuse receptacle is located on the rear panel. A removable six-foot, three-conductor power cord (Belden-type 17745, or equivalent) is plugged into the rear panel connector.

TABLE C

CONTROLS

CONTROL			
FUNCTION	NAME	TYPE	FUNCTION
MODE SELECTION	MODE	ROTARY	This four-position rotary switch is used to select DP, TT, PRIME, or TEST modes. Mode selection permits the user to enter digits into the appropriate memory location of the Model 3555 for verification and editing prior to sending. Subsequent to the above, the MODE switch is used to select the active memory during outpulsing of the stored digits.

TABLE C (Cont)

CONTROLS

CONTROL			
FUNCTION	**NAME**	**TYPE**	**FUNCTION**
DATA ENTRY	KEYPAD	PUSHBUTTON	The 12-button keypad with tactile feedback enables entry of DDD access numbers, priming digits, test preparation codes, and test request codes. The asterisk key (*) functions as a character erase key which deletes the last character entered. With Touch-Tone® signaling, the pound key (#) is indicated by a (P) on the display.
MEMORY ERASE	CLEAR	PUSHBUTTON	The CLEAR momentary pushbutton erases the memory field selected by the MODE switch. Information stored in the unselected memories remains unaffected.
INFORMATION OUTPULSING	SEND	PUSHBUTTON	The SEND momentary pushbutton initiates outpulsing of information stored in the memory selected by the MODE switch.
PAUSE IN DATA ENTRY	PAUSE	PUSHBUTTON	This momentary pushbutton is used during entry of data into either the DP, TT, or PRIME memory. Use of this pushbutton causes outpulsing of stored digits to stop at that point in the sequence. A pause is indicated by a dash (—) on the display. Pressing the SEND button causes outpulsing to resume after a pause.
	RCYL/ RFWD	TOGGLE	This two-position momentary toggle switch has spring return to the center position. RFWD causes a 100-Ms burst of 1300 Hz tone to be transmitted to the responder. RCYL causes a timed one-second burst of 1300 Hz tone to be transmitted, causing the ROTL to release its connection.
AUDIO MONITOR	MON VOL	ROTARY	This control is used to control the volume of the audio monitor. The monitor provides an audible means of alerting the user to dial tone and test progress tones. At its extreme counterclockwise position, ac power is switched off.
HOOKSWITCH	OFF HOOK/ ON HOOK	TOGGLE	The ON HOOK/OFF HOOK is a two-position toggle switch. When in the OFF HOOK position the Model 3555 RAU then seizes the circuit to which it is connected.

TABLE C (Cont)

CONTROLS

CONTROL			
FUNCTION	NAME	TYPE	FUNCTION
	LOOP/ 310 T/R	JACK	This 310 jack provides a DDD loop appearance on tip and ring. A sleeve ground return is provided in OFF HOOK for use when the instrument is directly connected to a ROTL frame.
EDITING DATA ENTRY	CURSOR	TOGGLE	This two-position momentary toggle switch has spring return to the center position. It controls the position of the flashing cursor on the display. When the switch is momentarily moved either to the left or right, the cursor steps one digit in the desired direction. If switch movement is maintained, after approximately one second, the cursor will begin to repetitively step. This movement of the cursor is automatically stopped when it reaches the first digit to the left or last digit to the right. To correct a digit which has been entered move the cursor, using the CURSOR control, so that the flashing dot appears to the immediate right of the digit which is to be corrected. The new entry is made with the keypad. When entered, the display will change accordingly and the cursor will step to the next digit of the sequence.
EXTEND DISPLAY	EXTEND DISPLAY	PUSHBUTTON	This momentary pushbutton and associated red LED permits the front panel display to read out either the first or last 15 digits entered into the 30-digit memory. The memory stores information for DP, TT, and PRIME signaling. If more than 15 digits are entered into any one of these signaling modes, the extended field (digits 16 through 30) will automatically appear on the display. When the extended field is being displayed, the associated red LED illuminates. Pressing the EXTEND DISPLAY pushbutton causes the alternate field to display.
POWER-UP	MON VOL	ROTARY	The power switch is incorporated in the monitor volume control. The associated POWER indicator (green LED) illuminates when the unit is powered up.

3. OPERATION

A. General

3.01 The Model 3555 accesses a ROTL by sending priming and test control signals to the ROTL. These signals are usually sent over a dial-up connection via the DDD network. The Model 3555 then decodes and displays the measurement data it receives from the ROTL. In this way, two-way testing between a near-end ROTL and a far-end responder or one-way testing between a near-end responder and far-end noise/tone source can be performed. The Model 3555 also permits office terminal balance testing toward a responder-equipped terminal.

3.02 After the Model 3555 is powered up, operating the unit consists of first programming dial-up, priming, and test control codes into the unit, then outpulsing these codes to the ROTL, and finally, interpreting the test results displayed by the Model 3555.

3.03 The initial power-on conditions are discussed under heading B below. The entering of dial-up, priming, and test control codes is discussed under separate headings C, D, and E below. Outpulsing is discussed under heading F, and the interpretation of test results is covered under heading G.

B. Initial Power-up

3.04 A 310-type jack is provided to connect the Model 3555 to either a DDD circuit or directly to a ROTL frame.

3.05 The Model 3555 is powered up by placing the MON VOL switch to on. The green POWER indicator lights when the unit is powered up. Also, a 5-second "PASS" message appears in the display field followed by a flashing cursor at the first digit position of the display.

C. Dial-up Access Number

3.06 Dial-up access to a ROTL is accomplished by using dial pulse (DP) or Touch-Tone® (TT) signaling. Entry of an access directory number into the Model 3555 is accomplished as follows:

(1) Place the MODE switch to the appropriate DP or TT position.

(2) Use the keypad and PAUSE control to enter the DDD access number into the Model 3555. The PAUSE control provides a delay (–) between digits when additional start-dial signals are anticipated. At NED, for example, an access number 9—(7-digit address) is used to dial out through a PBX to a nearby ROTL. The digit 9 accesses a trunk to Concord, the pause (—) provides a delay to await a second dial tone, and the DDD number (7-digit address) accesses a ROTL.

(3) The entered DDD access number appears in the Model 3555's display for verification. The DISPLAY EXTEND switch permits extension of the display beyond 15 digits and provides a check sum indication (See Fig. 2) for the total number of digits and delays entered. Use the CURSOR toggle, asterisk key(*), and/or CLEAR pushbutton to edit the access number.

Fig. 2—Check Sum Indication

REF. A02633-00

(4) DO NOT use the SEND control at this time.

D. Priming Code

3.07 MF signaling for control of an expanded ROTL is accomplished in the Prime Mode. Entry of a priming code into the Model 3555 is accomplished as follows:

(1) Set the MODE switch to its PRIME position.

(2) The priming format and content are determined by the type of switching equipment in the near-end office. As an example, Table D tabulates the priming formats appropriate for a step-by-step office. Use the keypad and pause control to enter the required priming digits. The KP and ST pulses, which are required to bracket the priming information for proper operation of the ROTL, are automatically inserted by the Model 3555. At NED, for example, the code 65 and a 7-digit address are often used as the priming information. Code 65 designates the type of test line (connection appraisal 105-type) and the 7-digit address accesses a far-end test line. Code 65 is entered first and separated by use of the DISPLAY EXTEND switch from the 7-digit address which is entered in the extended display.

Note: To facilitate possible troubleshooting, the PAUSE control is often used to enter a delay command after each priming digit. Delays can also be programmed before the first digit and after the last digit to delay outpulsing both after the KP and before the ST codes are sent.

(3) The priming digits appear for verification in the Model 3555's display. The DISPLAY EXTEND switch permits extension of the display beyond 15 digits and provides a check-sum indication for the total number of digits and delays entered. Use the CURSOR toggle, asterisk key (*), and/or CLEAR pushbutton to edit the access number.

(4) DO NOT use the SEND control at this time.

TABLE D

EXPANDED ROTL PRIMING DIGITS FORMAT FOR STEP-BY-STEP OFFICES

TEST TO BE PERFORMED			PRIMING DIGITS 1	2	3	4	5	6	7	8 THRU 14	9 THRU 18
TRANSMISSION TEST	CHECK BUSY	100-TYPE	0	0	TRUNK IDENTITY CODE				SEE NOTE	FAR-END TEST LINE NUMBER	
		102-TYPE	0	2							
		105-TYPE	0	5							
	OVERRIDE BUSY	100-TYPE	1	0							
		102-TYPE	1	2							
		105-TYPE	1	5							
OPERATIONAL TEST	CHECK BUSY	103-TYPE	2	3							
		SYNCHRONOUS	2	1							
		NON-SYNC.	2	0							
	OVERRIDE BUSY	103-TYPE	3	3							
		SYNCHRONOUS	3	1							
		NON-SYNC.	3	0							
BALANCE TEST			4	0							
	OVERRIDE MADE EASY		4	1							
MAKE BUSY AND RESTORE		MAKE BUSY	5	0							
		REMOVE MAKE BUSY	5	1							
TRUNK STATUS INTERROGATION	INDIVIDUAL TRUNK		5	2							
	TRUNK GROUP		5	3							

TABLE D (Cont)

EXPANDED ROTL PRIMING DIGITS FORMAT FOR STEP-BY-STEP OFFICES

TEST TO BE PERFORMED		PRIMING DIGITS								
		1	2	3	4	5	6	7	8 THRU 14	9 THRU 18
CALL BACK REQUEST		5	5	ID						
CONNECTION APPRAISAL	100-TYPE	6	0	FAR-END TEST LINE NUMBER						
	102-TYPE	6	2							
	105-TYPE	6	5							
HOME OFFICE TEST LINE TEST	100-TYPE	7	0	TEST LINE IDENTITY				CLASS 0, 2, & 6		
	SYNCHRONOUS	7	1							
	102-TYPE	7	2							
	103-TYPE	7	3							
	NON-SYNC.	7	4							
	105-TYPE	7	5							

Note: The signal class digits are defined as follows:

DIGIT	TRUNK CLASS TYPE
0	dial-pulse loop supervision
1	dial-pulse loop supervision with stop dial
2	dial pulse with simplex supervision
3	dial-pulse simplex with stop dial
4	MF signaling — loop supervision
5	MF signaling — simplex supervision
6	home office test of test line on selector banks
9	SAMA trunks

E. Test/Self-check Control Code

3.08 The test control code consists of a two-digit test preparation code and a two-digit request code. Use the directory card attached to the Model 3555 to determine an appropriate test code. The test preparation and request codes are listed on the front of this card. A list of expanded test request codes for use with expanded responders is also included. Below most of the test codes are self-check (SCK) codes which can be used to check the calibration of the ROTL measuring circuits. This directory card is also shown in Figure 3. As an example, control code 0177 combines test preparation code 01 (105-type test line)

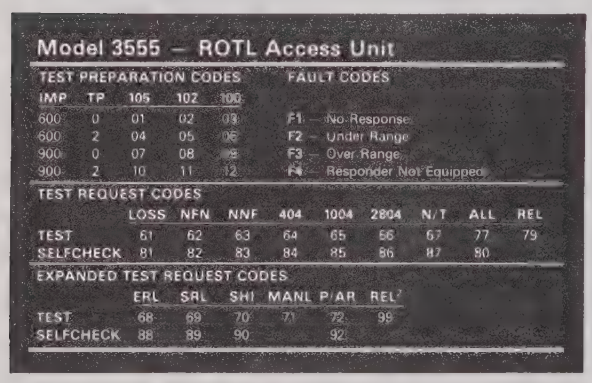
and test request code 77 (all tests 61 through 67 are to be performed). The FAULT CODES also shown on the card are explained under heading G ("Test Results"). Test request code abbreviations are listed on the rear of the directory card.

3.09 Entry of a test code into the Model 3555 is accomplished as follows:

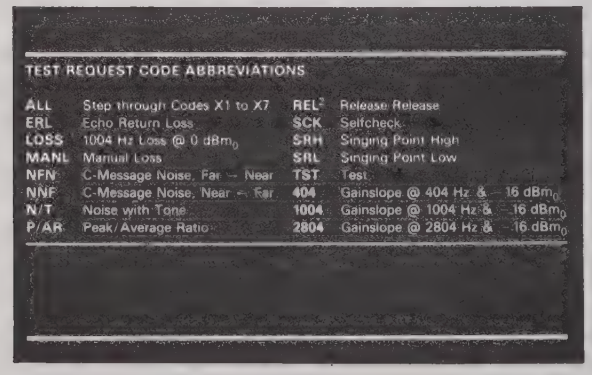
(1) Set the MODE switch to its TEST position.

(2) Use the keypad to enter the test preparation and request codes in sequence. Note that the code as displayed by the Model 3555 appears with a space separating the test preparation and request codes. For example, with WECO Model 52A and 56A Responders, the test code for a 600-ohm, 0-TLP, 105 test line, 400-Hz gain slope test command is displayed as 01 64.

(3) DO NOT use the SEND control at this time.


Model 3555 — ROTL Access Unit
TEST PREPARATION CODES
IMP TP 105 102 100
600 0 01 02 03
600 2 04 05 06
900 0 07 08 09
900 2 10 11 12
FAULT CODES
F1 — No Response
F2 — Under Range
F3 — Over Range
F4 — Responder Not Equipped
TEST REQUEST CODES
LOSS NFN NNF 404 1004 2804 N/T ALL REL
TEST 61 62 63 64 65 66 67 77 79
SELFCHECK 81 82 83 84 85 86 87 80
EXPANDED TEST REQUEST CODES
ERL SRL SHI MANL P/AR REL²
TEST 68 69 70 71 72 98
SELFCHECK 88 89 90 92

FRONT SIDE


TEST REQUEST CODE ABBREVIATIONS
ALL Step through Codes X1 to X7
ERL Echo Return Loss
LOSS 1004 Hz Loss @ 0 dBm0
MANL Manual Loss
NFN C-Message Noise, Far — Near
NNF C-Message Noise, Near — Far
N/T Noise with Tone
P/AR Peak/Average Ratio
REL² Release Release
SCK Selfcheck
SRH Singing Point High
SRL Singing Point Low
TST Test
404 Gainslope @ 404 Hz & 16 dBm0
1004 Gainslope @ 1004 Hz & 16 dBm0
2804 Gainslope @ 2804 Hz & 16 dBm0

REAR SIDE

Fig. 3—Model 3555 Test Codes

F. Outpulsing Test Control Code

3.10 After the dial-up, priming, and test control codes are programmed into the Model 3555, these codes can be outpulsed to the ROTL as follows:

(1) Place the MODE switch to the appropriate DP or TT position, and the ON/OFF HOOK switch to its OFF HOOK position. Observe the presence of dial tone on the audio monitor.

(2) Press the SEND button. The Model 3555 outpulses the dial-up number to establish an ROTL connection, and receives a test progress tone (TPT) tone from the accessed ROTL. Wait for the TPT to stop.

(3) Place the MODE switch to its PRIME position, then press the SEND button. The priming information and KP and ST pulses are sent to the ROTL. When outpulsing, the Model 3555 skips over any blank spaces at the end of the first 15-digit display and sends any digits stored in the extended-display.

Note: For code 103 intertoll trunk testing, two ring-forward tones must be transmitted to the near-end ROTL. Each tone is sent by momentarily pressing the RFWD/RCYL switch to its upper RFWD position.

(4) The ROTL returns test progress tones (TPT's) which can be audibly monitored with the MON VOL control. The TPT's are defined in Table E. Once the appropriate TPT's are received, the ROTL is ready to receive test control codes.

(5) Place the MODE switch to its TEST position and press the SEND button. The Model 3555 sends the test control codes to the ROTL. These command codes are usually heard via the audio monitor as a series of two or three MF tone pairs. As the tests are performed, test result measurements or fault indications are shown by the Model 3555. Test result indications are explained under heading G.

(6) After the test request code is sent, the display cursor remains positioned at the second digit of the code. The keypad can be used to change this last digit for a new test request code, or the CURSOR (or CLEAR) switch and keypad can both be used to change the entire test control code.

(7) After a test control code is transmitted, it is automatically re-transmitted at 14-second intervals unless the code is changed as in Step 6, or the SEND button is pushed before the end of a 14-second interval. For a test-all request code (77) the request code changes from 61 through 67 as the SEND button is pressed.

(8) The ROTL can be reset for new priming information by sending it a recycle tone. This recycle tone is sent by pressing the RFWD/RCYL to its RCYL position. Then reset the MODE switch to its PRIME position, use the keypad to reprogram the priming code, and return to Step 3 of this procedure.

TABLE E

TYPICAL AUDIBLE RESPONSES

TEST LINE	1ST TPT	2ND TPT	3RD TPT
105-type	trunk is available	far-end test line and far-end responder are connected	near-end responder is connected
102-type	trunk is available	near-end responder and far-end test-line are connected	none
100-type	trunk and near-end responder are available	far-end test line is connected	none

Note: The TPT is a 2225-Hz signal. Other possible responses include:

1. An initial 3-seconds of 60-IPM tone indicates that the trunk is busy.
2. An initial 3-seconds of 120-IPM tone indicates that invalid information was sent to the ROTL.
3. After the 1st TPT is received, a 60- or 120-IPM tone indicates that the far-end circuit is busy or that no answer supervision was received, or in the case of a 102-type test line, that the near-end responder has been made busy.
4. When a 105-/102-test line is used, a 60-/120-IPM tone received after the second TPT response indicates that the near-end responder has been made busy.

G. Test/Self-check Display

3.11 Approximately 1/2 second after the test/self-check codes are sent by the Model 3555, data measurements sent back by the near-end ROTL appear on the display of the Model 3555. In the case of two-way measurements, both far-to-near (F→N) and near-to-far (N→F) results are displayed. When one-way measurements are made, results are shown under an appropriate label.

3.12 Negative test values (e.g., a gain slope equal to − 16 dBm) are displayed with a minus sign. Positive values are unsigned; however, a positive loss measurement is shown as a flashing set of digits to alert the user to a possible problem-related measurement.

3.13 A self-check (SCK) display indicates the deviation error in the responder measuring circuits. A deviation of 0 indicates the ROTL measuring circuits are perfectly calibrated. Deviations are presented as unsigned values. Values of up to 0.2 dB are typically permissible for level and gain slope; deviations of up to 2 dBrnC are permitted for noise and ERL self-check.

3.14 In several situations fault indications will appear on the display. Fault codes F1 through F4 are defined in Figure 3. Range fault codes F2 and F3 pertain to low-to-high limits programmed into the Model 3555. These limits are tabulated in Table F. In addition, the code F0 indicates an invalid test code; ie., a code not recognized by the Model 3555 has been used.

TABLE F

RANGE LIMITS

MEASUREMENT	LOW LIMIT	HIGH LIMIT
Loss	− 16 dB	+ 7 dB
Gain slope	− 37 dB	− 13 dB
Noise	14 dBrnC	56 dBrnC
Noise with tone	33 dBrnC	75 dBrnC
Echo return loss	0 dBrn	40 dBrn

4. MAINTENANCE AND SERVICE

A. General

4.01 The Model 3555 uses microprocessor control for all of its functions. All signaling frequencies, timing intervals and display decoding are precisely controlled by a common crystal time base. No field calibration is required for the unit.

4.02 The microprocessor architecture of the Model 3555 also permits the programming of the unit to be readily modified via the interchange of plug-in EPROMs which store the programming routines for the microprocessor. This feature will permit revisions to the testing sequence of the Model 3555 in order to accommodate any future changes in measurement routines of the responder with which it communicates.

B. Maintenance Considerations

4.03 Access to the electronic circuit boards with the Model 3555 equipment housing is gained by removing the four 6-32 × 5-inch screws inside the rubber mounting feet which appear on both sides of the bottom of the instrument case. After removing the screws, the top of the case can be lifted to provide access to the internal circuit boards. Two plug-in circuit boards will be visible inside the unit. The microprocessor sub-system assembly mates with connectors J5 and J6 of the interconnecting mother board at the bottom of the unit. A 40-pin DIP connector also terminates on this board for interconnections of the displays and controls of the front panel. A second plug-in circuit board mates with connectors J9 and J10 of the mother board; it contains the analog interface circuitry.

4.04 Field repairs involving replacement of components within a module are not recommended; exchange of plug-in boards is suggested.

C. Initial Inspection

4.05 The access unit is carefully inspected, both mechanically and electrically before shipment. It should be working properly when received. If damage from transit is found, notify the transportation carrier immediately.

D. Service Information

4.06 Complete warranty information is contained in the purchase order agreement under terms and conditions of sale. Summarized briefly, the

Northeast Electronics warranty extends for a period of one year to the original purchaser of a Northeast test instrument. Northeast's system products are covered by a special warranty which can be summarized as follows:

- ☐ Hardware items are warranted for a period of 90 days.
- ☐ Software is warranted for a period of one year.

4.07 It is recommended that Northeast's Repair Department be contacted for assistance if, for any reason, a Northeast product fails to perform as expected. This step eliminates the needless delay entailed when a product is returned unnecessarily. Contact the Repair Department at Northeast Electronics, P.O. Box 2021, Concord, New Hampshire 03301; telephone: (603) 228-3700.

4.08 If a Northeast Electronics product requires factory servicing ***during*** the warranty period, be sure to include a ship-to address and a description of the problem when returning the product to Northeast Electronics.

After the warranty period has expired, equipment returned must be accompanied by all of the following:

- ☐ The number of the purchase order covering the cost of servicing,
- ☐ Bill-to address,
- ☐ Ship-to address, and
- ☐ Description of problem.

4.09 In all cases, Northeast Electronics products should be returned directly to our Factory Service Center in Concord, New Hampshire for repair. Any material requiring repair must be returned to Northeast via a Return Material Authorization (RMA) Number, which will be assigned by the Service Center Order Processing Administrator. Customers may call the Factory Service Center at 1-603-228-3700 for the assignment of the number.

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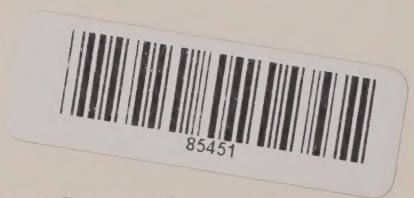
Prepared By: Rick Schultz	Approved By: [signature]
Issued By: Jim Steinau	Issue Date: 10/19/93

CHANGE NOTICE SUMMARY

Revision	Reason for Change	Date of Change



northeast electronics
DIVISION OF tau-tron inc.
A UNIT OF GENERAL SIGNAL

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1-603-228-3700 1-800-222-4124 (Outside N.H.)